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COAL FATAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
DISTRICT I

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REPORT OF FATAL COAL BUMP ACCIDENT
FEDERAL NO. 1 MINE
FEDERAL MINING CORPORATION
ELKHORN CITY, PIKE COUNTY, KENTUCKY

April 17, 1963

By

J. L. Gilley
Mining Health and Safety Engineer

Originating Office - Bureau of Mines
Norton, Virginia
J. S. Malesky, District Supervisor
Health and Safety District I

REPORT OF FATAL COAL BUMP ACCIDENT
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INTRODUCTION

This report is based on an investigation made in accordance with provisions of the Federal Coal Mine Safety Act (66 Stat. 692; 30 U. S. C. Secs. 451-483).

Willard Owens, loading machine helper, was killed instantly by a coal-pillar outburst in the No. 1 room, No. 3 barrier pillar 4 east section in the Federal No. 1 mine about 6:45 p.m., Wednesday, April 17, 1963. At the time of the outburst Owens was relieving the regular operator during the lunch period. Owens, age 44, had 19 years mining experience, all at this mine, with the last 10 years as a loading machine helper. He is survived by his widow.

The Bureau of Mines office, Pikeville, Kentucky, was notified of the accident about 8:00 p.m., April 17, 1963, by Everett Brown, Inspector-in-Charge of the Pikeville Office, Kentucky Department of Mines and Minerals. An investigation was started the following day and completed April 23, 1963.

Information for this report was obtained from an investigation at the scene of the accident, which had not been disturbed, and from statements of eyewitnesses and from mine officials.

GENERAL INFORMATION

The mine is opened by drifts in the Elswick coal bed, which averages 38 inches in thickness. In the immediate area of the outburst the coal bed ranged from 38 to 45 inches in thickness. The coal is characteristically black and shiny and possesses a comparatively high degree of hardness; the top half of the coal bed is brittle and thus shatters or breaks somewhat readily under stress or blow. Pulverization of the coal by abnormal stress upon the pillars in the immediate area of the outburst produced the characteristic dark brown color of bituminous coal. The face and butt cleavage planes of the coal bed are discernible but are not pronounced. Structure of the coal indicates that it is capable of developing latent energy in comparatively small pillars. Large pillars situated on a pillar point could be potential outbursts.

A total of 48 men, 42 underground and 6 on the surface, was employed on 2 shifts a day, 5 days a week, and produced a daily average of 400 tons of coal, all loaded by Joy 14 B.U. loading machines into shuttle cars.

The mine was developed by a multiple-entry system, and pillar extraction follows a room-and-pillar method of development. Entries ranged from 5 to 11 in number on 60-foot centers and varied from 18 to 25 feet in width. Rooms were normally projected on 60-foot centers and were driven from 20 to 30 feet in width. Crosscuts were projected on 80-foot centers. Present mining consists of extraction of pillars in 2 sections of the mine. The adopted method of extraction of pillars was by mining successive open-end lifts from the room side or from the crosscut side of the pillars. A split-and-fender method of extraction was used in some instances. Alternate open-end lifts were mined simultaneously in the same pillar where conditions permitted. Pillars were of various dimensions and shapes, as noted in sketches 2 and 3. Pillaring normally was started as soon as a panel of entries was driven to the boundary or at a predetermined distance. Pillars were generally extracted on about a 45-degree extraction line, except that the top end of the pillar line was at times kept flat. The coal was undercut to a depth of about 7 feet with shortwall mining machines.

The depth of the cover over the 4 east area ranged from about 917 to 1,000 feet. The irregular crests of the mountain range on the property attained a maximum elevation of 1,650 feet. The roof, overlying the coal bed in the area of 4 east involved in the outburst, was comparatively strong, nearly horizontal, thinly laminated gray sandy shales. From observations of falls at the fringes of the caved area, the structures of the series extending several feet above the coal bed were predominantly sandy shales of variable thicknesses with definite intervening bedding planes that usually permit easy detachment from the next overlying stratum. Thick beds of sandstone overlay the immediate sandy shale roof.

The immediate mine floor was very hard, firm shale, several inches in thickness, that apparently heaves readily in some areas of the mine under pressure. The floor had heaved to some extent at localized areas in each of the 3 rooms in the 4 east barrier area.

Methods of roof-support used in the 4 east area consisted of rows of posts on 4-foot centers along each side of the roadways and a minimum of 2 safety posts at the working faces. Breaker and turn timbers were required at the entrances to the pillar lifts in addition to one or more rows of posts set on 4-foot centers next to the gob area during the mining of the pillar lifts. Roof-bolting had been used in several areas of the mine, but this method was not utilized in the 4 east area. The roof-support plan was complied with and the roof-testing practices were satisfactory during the last Federal inspection completed April 10, 1963.

The mining system used, the extent of development and extraction, and the comparative dimensions of the coal pillars in the 4 east territory at the time of the coal bump are illustrated in sketches 2 and 3. The location of the workmen and equipment at the time of the bump and the extent of the area affected are shown in sketch 2.

Investigations of the accident were made on April 18 and 22-23, 1963. Members of the investigating committee one or more days were as follows:

FEDERAL MINING CORPORATION

John B. Mays	Mine Foreman
Estill Collins	Section Foreman
James Wooten	Section Foreman

UNITED MINE WORKERS OF AMERICA

Corbin Spears	Mine Safety Committee
Cecil Swinney	Mine Safety Committee
Jesse Adkins	Timberman (Eye-witness)
Harvey Ratliff	Shuttle-car operator (Eye-witness)

OLD REPUBLIC INSURANCE COMPANY

Howard Jones	Coal-Mine Inspector

KENTUCKY DEPARTMENT OF MINES AND MINERALS

Henry Hamlin	Principal Inspector
Everett Brown	Inspector-in-Charge

UNITED STATES BUREAU OF MINES

O. W. Harris	Federal Coal-Mine Inspector
Jack E. Tisdale	Federal Coal-Mine Inspector
J. L. Gilley	Mining Health and Safety Engineer

DESCRIPTION OF ACCIDENT

Mining at the time of the outburst consisted of the extraction of entry and barrier pillars in 2 sections. In 1956, the 2 North entries were turned off the main entries and were driven 350 feet where a parallel set of multiple entries was projected. The 2 North group consisted of 7 entries driven 3,800 feet in depth, and the right group of 5 and 6 entries, extended to a depth of 4,400 feet. The 2 groups of entries were separated by 5 barrier pillars, ranging from 300 to 350 feet in width and from 400 to 500 feet in length. (See sketch 3.) After the 2 North entries were developed, pillar extraction was started in the

right group and the entry pillars were recovered for a distance of 3,000 feet, leaving the barrier pillars and the entry chain pillars on the left side intact. In 1960, extraction of the 2 North entry and barrier pillars was started and continued for a distance of 2,000 feet to the No. 3 barrier pillar involved in the outburst. This barrier was originally 320 feet wide and 490 feet in length, but it had been reduced to 200 feet in width and 220 feet in length when 3 rooms designated as Nos. 1, 2 and 3 were projected for development preparatory to extraction. At the time of the outburst, the 3 rooms were being driven simultaneously, nearly abreast, through the barrier pillar directly toward the old gob area completed in 1962. It was reported several pillar remnants of various dimensions were not mined in the area. From sketch 2, it will be noted that more coal was left for pillaring from No. 1 room than the other 2 rooms. The widths of the rooms varied from 21 to 31 feet and the crosscuts were driven at irregular intervals. This unsystematic method of projection and development of the barrier pillar resulted in the formation of pillars of various dimensions and shapes. From sketch 2, it will be noted that the pillars in No. 1 room were not only the largest of the group, but were situated adjacent to a previously mined-out area that formerly comprised the inby portion of the contingent barrier pillar and formed a pillar-line point.

On the morning of April 17, 1963, the No. 1 room "holed" through into an old gob area from which the coal was mined in October 1962. The Nos. 2 and 3 rooms each lacked about 7 feet "holing" through at the end of the shift. After the No. 1 room "holed" through to the gob, the day shift crew started a pillar lift in the last pillar from the room-side in No. 1 room. (See sketch 2.) In starting this pillar lift, the loose coal was loaded from the rib of the pillar with the loading machine, then the place was undercut and blasted. This cut of coal was loaded on cycle during the shift, and the pillar lift was undercut the second time and the cut of coal was blasted. However, this pillar lift was not "open-ended" according to plan but was arc-shaped.

The section foreman stated that while the second cut of coal was being loaded, a bump occurred in the No. 2 crosscut. (See sketch 1). Upon investigation, the foreman found that about 4 tons of coal had bumped from the right rib. He further stated that inasmuch as he had detected some broken roof along the roadway outby the first pillar lift, he decided to timber the pillar lift and start extraction of the pillar from the crosscut side where the bump had occurred. The loading machine was moved into the crosscut and the expelled coal from the pillar was loaded. The loading of coal from the face of the crosscut and pillar ribs was continued until the coal was too hard to dig with the loading machine. The loading machine was then trammed into the No. 2 room. The foreman had several timbers set in the new pillar place in the crosscut of No. 1 room, but did not have time to complete the timbering job before quitting time at 3 p.m.

On the evening of the coal outburst, the 4 esst section night-shift crew, comprising 8 men and the section foreman, arrived on the section about 3:30 p.m. After the scrap cut in the No. 2 room and a cut of coal in the No. 3 room were cleaned up, the loading machine was then trammed into the "pillar pocket" started by the day-shift crew in the No. 2 crosscut of No. 1 room. The night-shift section foreman stated that when he examined the places on the section immediately prior to starting his crew to work, he discovered what he thought "was a cut of coal shot down by the day shift in the No. 2 crosscut pillar place", notwithstanding that the report from the day shift foreman indicated that the timbering job had to be completed in the place before it was ready for undercutting. A coal outburst had occurred in the place during the 30-minute interval between shifts and the foreman had mistaken the coal expelled by a bump from the ribs of the pillars for a cut of coal. The loading machine operator started loading coal in the No. 2 crosscut "pillar pocket" at about 5:00 p.m. The accident occurred at 6:45 p.m. Coal was being loaded into a shuttle car from the rib of the pillar on the right side of the crosscut, according to a timberman, who witnessed the outburst and who was setting timbers on the left side of the place about 10 feet from the loading machine, when the outburst occurred.

The outburst was rather violent, and the loading machine was moved outward from its original position near the pillar rib, a distance of 10 feet. The loading machine operator was killed instantly, and the timberman was stunned momentarily.

The dust created by the coal outburst soon cleared. The foreman and other crew members found the deceased near the loading machine. He was placed on a stretcher and removed to the surface.

A void was left by the outburst of coal from the crosscut. The void measured from 6 to 24 inches in height, about 8 feet in width and extended about 16 feet in length. Expulsion of coal from pillar ribs was confined principally to the crosscut area in No. 1 room. Some coal was shaken from 2 or more sides of 4 other pillars. The roof was not affected insofar as could be determined, except at one place in an abandoned pillar lift. Four timbers were dislodged in the immediate area, and a few timbers were broken along the No. 1 roadway. The loading machine contactors were damaged and other parts of the machine were also damaged to some extent.

The pillar involved was 103 feet long and 63 feet wide. Because of the large size it was capable of withstanding much stress.

The section foreman stated that he had examined the place about 5 minutes prior to the outburst and did not detect or perceive any unusual conditions or circumstances that indicated the likelihood of an outburst.

The immediate roof had caved at intermittent locations inby the extraction line sometime prior to the outburst. However, at the time of the investigation, the main roof could be seen at two locations extending seemingly intact some distances inby the active area. Reportedly, the immediate roof caved in part of the mined-out area inby the No. 1 room within a few hours after the outburst. Pillar remnants were in evidence in the gobs. Reportedly, a few complete pillars were left intact in the recently mined out area. The unmined pillars and pillar remnants, undoubtedly, delayed and/or prevented the thick overlying roof from caving, as desired, thus likely imposing additional stress or load on the newly developed room pillars, especially the large pillars in No. 1 room. The irregular outline of the No. 2 crosscut (scene of outburst) indicated that the coal had been mined with the loading machine from the left rib sometime prior to the outburst, and according to statements of witnesses, the same procedure was being followed in mining coal from the opposite rib of the pillar. Excessive widths of several of the openings could have been instrumental in helping to create a differential in the load carrying capacity of the pillars. Extraction of comparatively large blocks or coal, such as the barrier pillar involved, when stressed on 2 or more sides from superimposed abutment loading from gob areas and surrounded on the opposite sides by numerous small pillars in the presence of factors favorable for outbursts, can be hazardous even under controlled conditions.

The mining methods, practices, and natural conditions are primary factors to be considered in dealing with coal-mine bumps. Circumstances under which this coal-mine outburst occurred are evidence that a combination of natural conditions favorable for such occurrences existed on the section. Where mining is done in the presence of natural conditions favorable or conducive to outbursts, every precaution is necessary to avoid, insofar as possible, critical areas through proper mining methods and practices.

CAUSE OF ACCIDENT

The coal mine outburst was the result of an accumulative process from a combination of the several factors, such as: unsystematic method of pillar extraction, incomplete extraction of pillars, and creating critical areas. Probably, the outburst was triggered by stresses from percussion created by the loading arms of the loading machine striking and penetrating the highly stressed pillar.

RECOMMENDATIONS

Compliance with the following recommendations may prevent accidents of a similar nature:

1. The mining system should require that coal pillars be developed as nearly uniform in shape and size as practicable.

2. The mining system should produce the least number of critical areas during retreat mining. (Critical areas are produced by pillar-line points, pillars not developed sufficiently in advance of the retreat line, improper sequence in development and extraction).

3. Complete extraction should be striven for and pillar remnants should not be left. However, where it is impossible to recover pillar remnants, their load-carrying capacity should be destroyed, if conditions will permit this to be done safely.

4. Pillars should be recovered in proper sequence and in a straight and orderly manner so as to reduce the possibility of offset pillar-lines, pillar-line points or points projecting into the gob.

5. Where pillar recovery is done in areas where natural conditions in combination are favorable or conducive to coal outbursts, every effort should be made to extract the coal pillars in a manner that will permit, insofar as possible, orderly distribution of induced mining stresses.

6. The pillars should be recovered by the open-end method; however, where roof conditions present a hazard, a thin wing or fender is permissible. The lifts should be driven so that each lift and adjacent consecutive lifts will be mined along the gob sides of the pillars. Preferably, only one lift should be mined in a pillar at a time and not more than 18 feet in width.

7. Pillar lifts should not be driven at excessive widths into a pillar so as to cause the mining process to evolve into the pillar being "pushed out" instead of being extracted by successive open-end lifts of nominal width in proper sequence.

8. Under no circumstances, where natural conditions are conducive to or favorable for outbursts, should groups of rooms (such as those involved) be driven or developed abreast into highly stressed areas of coal pillars (abutment pressure zone) toward the gob.

9. Digging and loading the loose coal from the rib lines and faces of pillar lifts in highly stressed pillars usually result in tight corners outby the extraction line, thus creating a potential bump condition. Such practices should not be permitted, especially where conditions are favorable or conducive to coal bumps.

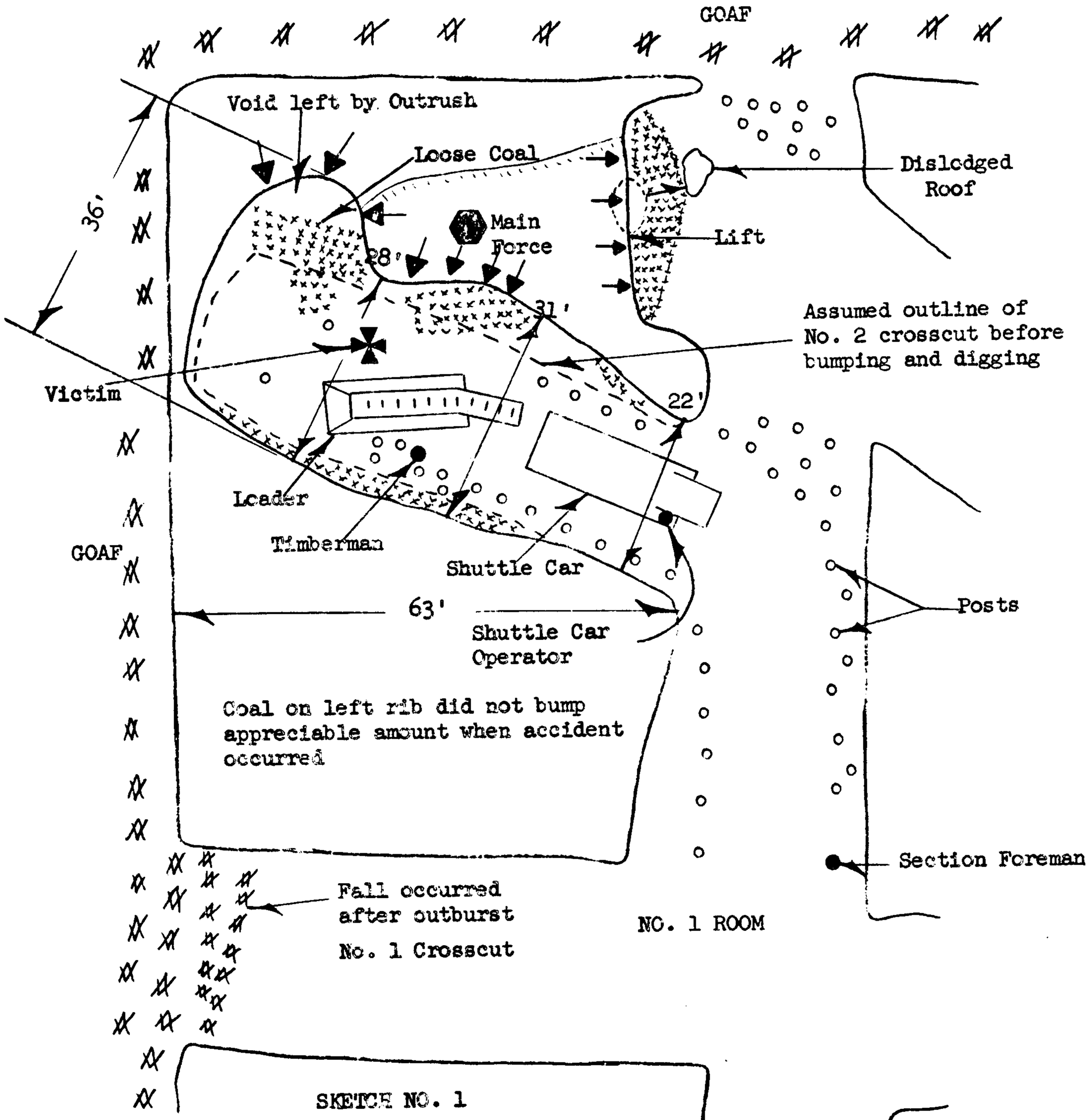
ACKNOWLEDGMENT

The writer gratefully acknowledges the courtesy and cooperation of the employees, members of the Mine Safety Committee, mine officials and representatives of the Department of Mines and Minerals.

Respectfully submitted,

/s/ J. L. Gilley

J. L. Gilley
Mining Health and Safety Engineer



SKETCH NO. 1

FATAL COAL BUMP ACCIDENT
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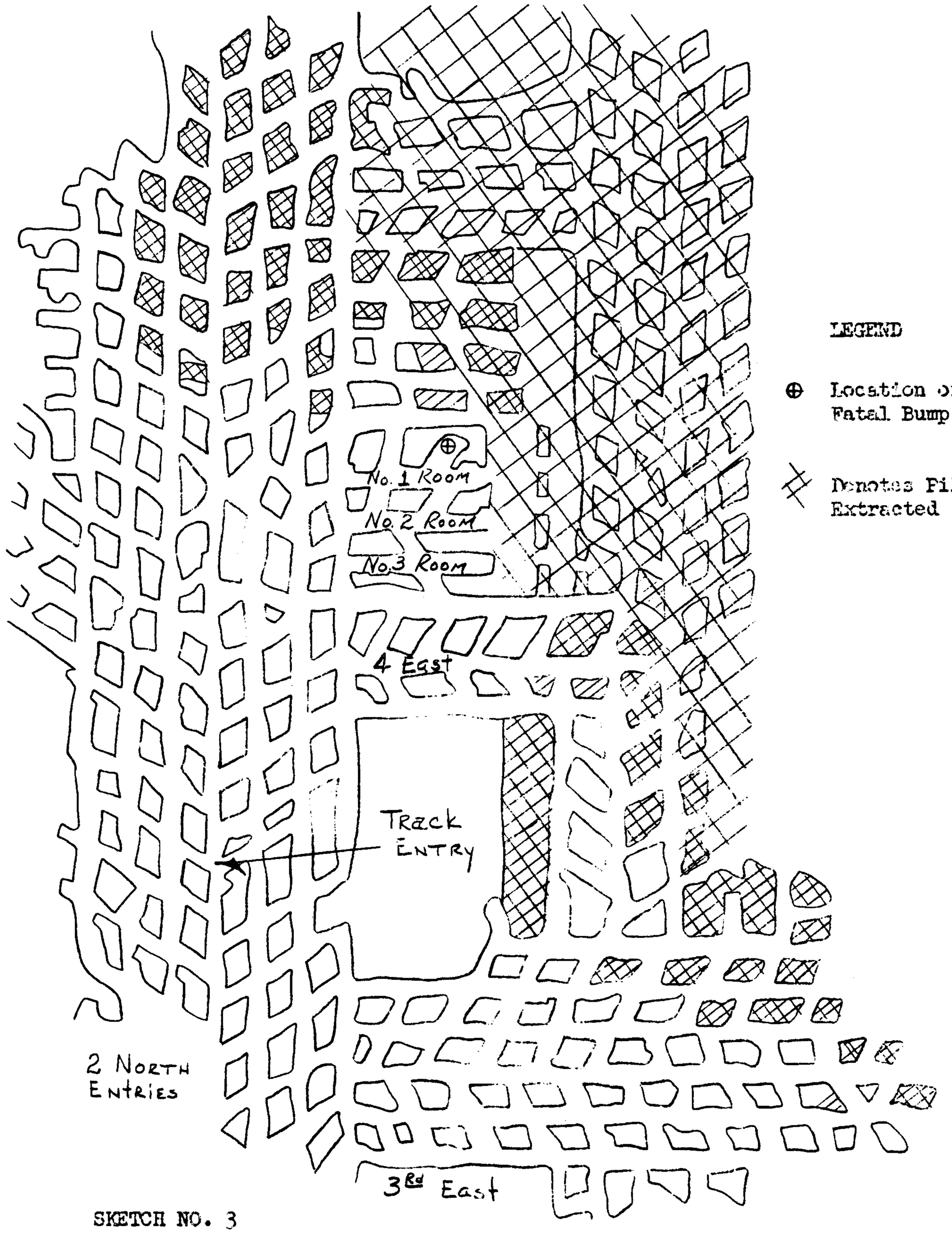
ELKHORN CITY, PIKE COUNTY, KENTUCKY

April 17, 1963

SCALE 1" = 20'



LEGEND

⊕ Location of Fatal Bump

# Denotes Pillars Extracted

SKETCH NO. 3

FATAL COAL BUMP ACCIDENT
FEDERAL NO. 1 MINE
FEDERAL MINING CORPORATION
ELKHORN CITY, PIKE COUNTY, KENTUCKY
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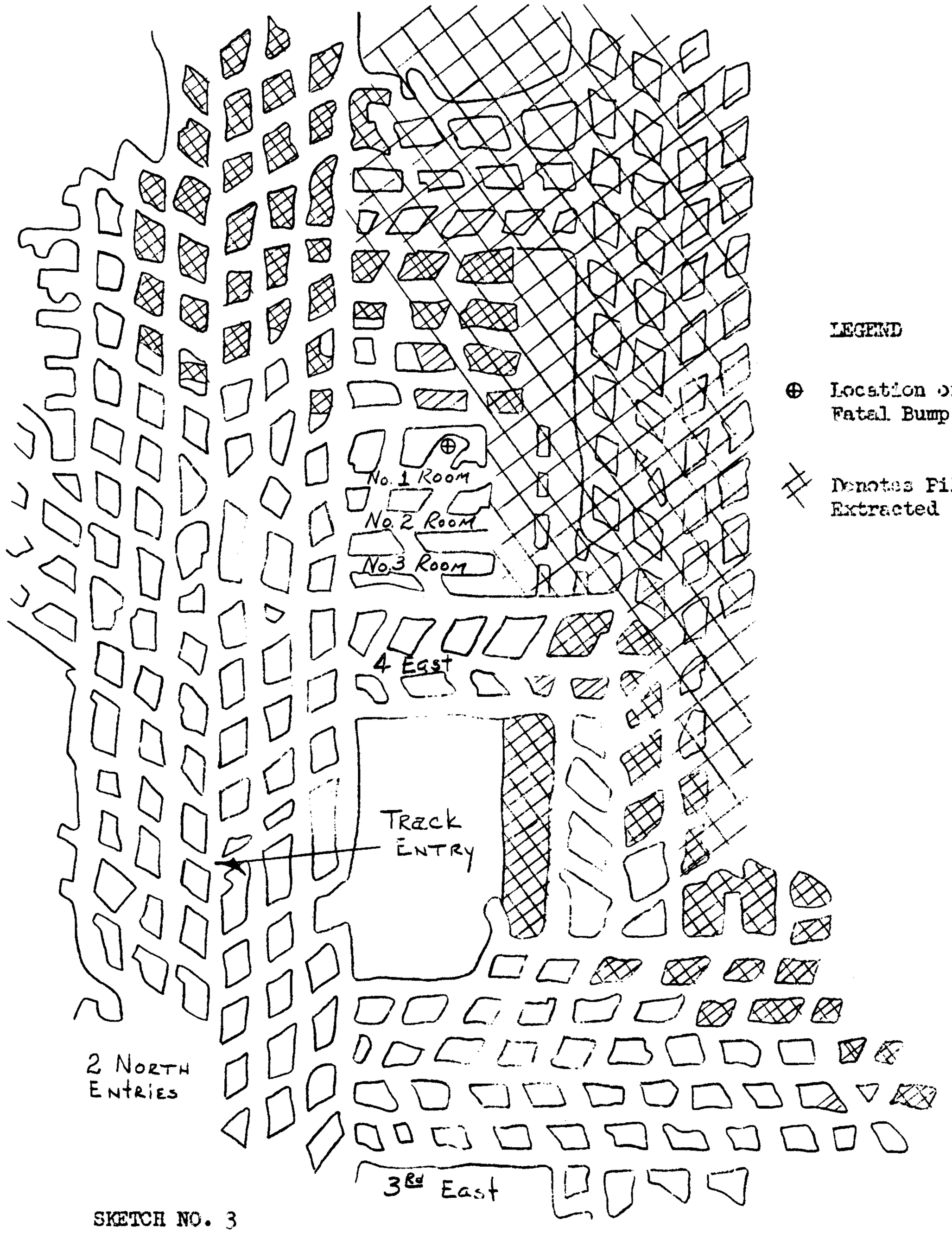
SCALE 1" = 200'



LEGEND

⊕ Location of Fatal Bump

# Denotes Pillars Extracted

SKETCH NO. 3

FATAL COAL BUMP ACCIDENT
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SCALE 1" = 200'